

REMARKS

Although explained in applicants' response to the previous Office Action, there still appears to be some misunderstanding regarding the teaching of the references versus the invention.

It behooves the inventors hereof, then, to briefly describe the path of invention and its significance prior to discussing again, the prior art relied upon by the Examiner.

The inventors hereof have discovered a way to reduce the size of a compression machine by as much as 70%. Such a size reduction can make it possible to place an engine of the invention in an automobile while retaining the power of a much larger conventional machine. This has been made possible by the discovery of a synergistic effect of engineering the engine with both counterrotation and boundary layer removal. By using both together, it is possible to dramatically increase the pressure rise per blade row in the compressor. The higher the pressure rise, the more work is required to turn the compressor blade rows. Because each blade row (of the invention) requires more work to support the higher pressure rise, more of the power generated in the turbine is absorbed by each blade row. As the Examiner is well aware, conventional machines require 5-10 compressor blade rows to absorb the work of a turbine rotor. This is because conventional compressor blade rows do not have a high enough pressure rise to require more power due to other concerns and limitations. Suffice it to say that 5-10 compressor blade rows are known to be necessary for the power produced by a turbine blade row to be absorbed. In the invention, conventional wisdom is replaced by a new teaching employing the synergistic effect of counterrotation and

boundary layer removal at the design stage of a machine to reduce its overall size by allowing for a dramatic reduction in the number of compressor blade rows required to absorb the power of a single turbine blade row. The compressor blade rows have a high enough pressure rise, made possible by the synergistic effect of counterrotation and boundary layer removal, to absorb all of the power made in the turbine with only two compressor blade rows. This is not taught, disclosed or even suggested in the prior art. If the Examiner understands what has been stated and claimed, he will find it axiomatic that the invention is not taught in the prior art. Otherwise, the teaching of the prior art can be better understood and thus the distinction better understood from the following.

It is important to an understanding of the claimed invention that, as stated in the previous papers filed, compressors are distinct from turbines, and something taught for one of them does not suggest the inclusion thereof in the other. Giffin, III et al. teaches counterrotation in a TURBINE; there is no teaching, disclosure or even a suggestion in Giffin, III et al. that counterrotation is indicated or even possible *in a compressor*. Applicants pointed out that lack of teaching in the previous response but perhaps the distinction was not immediately evident to the Examiner because of the focus on the new secondary references. There is a very good reason that Giffin, III et al. does not teach counterrotation in the compressor. Counterrotation in the compressor is limited to two counterrotating blade rows due to the mechanical constraints of connecting shafts. As the Examiner undoubtedly knows, on the order of 5 to 10, conventional compressor stages are required to absorb the power of one turbine stage in steady state operation of the engine in

order to be balanced, i.e, all of the power of the turbine must be absorbed in order for the engine to run properly.

Because of this constraint, counterrotation in the compressor has never been practical and thus the art teaches away from the use of counterrotation in compressors. It is perfectly clear to see then why Giffin, III et al. does not teach counterrotation in the compressor but rather teaches counterrotation only in the TURBINE....As far as Giffin, III et al. knows, the engine cannot be balanced (turbine to compressor) using counterrotation in the compressor because of the mechanical limitation on the number of stages possible. There simply needs to be more compressor stages than are possible to balance even a single turbine stage.

The British and German references teach boundary layer removal in the compressor. They teach nothing about counterrotation anywhere in the engine and make no connection between counterrotation and boundary layer removal.

Combining the teaching of Giffin, III et al. with DE '132 and GB'722 leads to an engine with boundary layer removal in the compressor and counterrotation in the turbine. This is not what is claimed in the present invention. Thus, the claims of this invention cannot be unpatentable over the combination set forth by the Examiner.

The inventors of the present invention discovered a way to work within the mechanical limitations of counterrotation of the compressor by using boundary layer removal to increase the work per stage of the compressor to such a degree that the counterrotating stages actually absorb all of the power of the turbine to create a balanced engine. The ability of the counterrotating compressor stage to absorb the power of the turbine through boundary

layer removal and counterrotation combine is due to the much higher pressure increase possible in each stage of the compressor because of these synergistic modes of operation.

As the claims clearly set forth, what is considered the invention is the combination of counterrotating stages and boundary layer removal in an engine, which combination makes operation of such an engine possible. Without boundary layer removal, counterrotation is not feasible; without counterrotation the number of stages is larger so that the engine is larger.

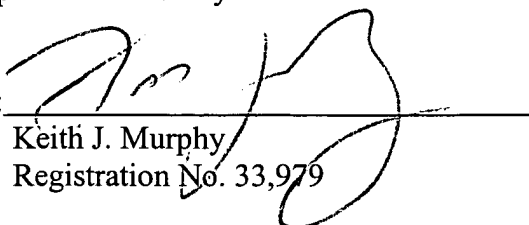
The invention allows for reduction in size of an engine from 50% to 70%. This reduces materials and weight and therefore is a great advance and benefit to the art.

In the event the Examiner has queries regarding the instantly submitted response, applicant's attorney respectfully requests a telephone conference to discuss any matters in need of attention.

If there are any fees with respect to this paper or otherwise, please charge them to Deposit Account No. 06-1130, maintained by applicants' attorney.

Respectfully submitted,
JACK L. KERREBROCK ET AL

FISHMAN, DIONNE, CANTOR & COLBURN
Applicants' Attorneys

By: 
Keith J. Murphy
Registration No. 33,979

Date: August 27, 1998

Address: 88 Day Hill Road, Windsor, Connecticut 06095

Telephone: (860) 688-4470